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An Atomizing Nozzle Assembly Attachment for Use With IMPROVED ROW-CROP SPRAYER AND DUSTER FOR POTATOES AND OTHER ROW CROPS[1]

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REVIEW OF SPRAYER AND DUSTER

In the design and operation of a special row-crop sprayer-duster (see Young et al. (4)[3]), the spray nozzles and dust outlets are positioned at or near ground level by means of free-floating, trailing arms. The trailing ends of these arms are provided with shoes which slide on the surface of the ground at a midposition between planted rows. Spray and dust branch arms at right angles to the rows are provided also for directing the sprays and the dusts toward the plants in each row from each side. The bottom units may be directed slightly upward so that the initial impact of the material is to the under surfaces of the leaves on the basal part of the plant canopy.

1/ This is a supplement to (4) in list of Literature cited. Cooperative investigations of the Agricultural Engineering Research and Entomology Research Divisions, Agricultural Research Service, USDA, the Washington State Potato Commission, and the Oregon and Washington Agricultural Experiment Stations.

2/ Young is an agricultural engineer and Chamberlin, Getzendaner, and Deonier are entomologists, all stationed at Forest Grove, Oregon.

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3/ Numbers in parentheses refer to Literature cited at end of report.

DESIGN AND OPERATION OF NOZZLE ATTACHMENT

High-velocity air streams have been used for a number of years to help break up and propel sprays to plant foliage and other surfaces. This use has been employed in a wide range of applications as shown by Brown (1), Potts (2), and Tenhet (3), among others. This publication reports the development and test of a nozzle-positioning attachment to utilize the air stream delivered through the dust tubes of the previously mentioned row-crop duster-sprayer to convey and circulate to and through the plant foliage an atomized spray issuing at the end of the dust tubes. The attachment consists essentially of a streamlined nozzle body and stem by means of which the nozzle is held in position in the dust-tube outlet. The atomizing nozzle employed is similar in design to those used in oil-burning heating systems to deliver finely atomized sprays under moderate pressures (Monarch type F-80 or equal).[4] In general, this nozzle delivers the insecticide in a cone-shaped pattern, the spray break-up occurring within the nozzle or as it leaves the nozzle orifice. The high-velocity air stream discharging around the nozzle picks up the spray, breaks it up to some extent, and conveys it to the plant, forcing it within the plant canopy.

The streamlining of the nozzle body reduces to a minimum the amount of air turbulence through the dust outlet. The directed high-velocity air through the dust outlet is usually sufficient to overcome the effects of normal surface winds. This air blast agitates the plant so that the spray circulates through it. The directed air blast from each side of the row also carries a portion of the spray across the planted row. In the plant area each air blast impinges against the air blast from the opposing outlet. This results in the air streams taking an upward path, thus aiding in depositing material on the under surfaces of foliage on both sides of the row.

Figure 1 is a pictorial view of the nozzle assembly; figure 2 is a working drawing of the assembly unit. This unit is mounted in a sleeve which clamps over the flange of the 90° elbow on the dust tube. The nozzle assembly may be made as an integral part of the dust tube by mounting it directly to the flange of the elbow. However, the separate sleeve mounting does offer some additional advantages in that sleeves of variable lengths can be used to release the material closer to the plant for variable row spacings employed for different crops. A detail drawing of components of the trailing boom assembly ((4), fig. 5) shows the 90° elbows as fittings that may be fastened as soldered joints. These fittings should preferably be made adjustable so that the outlet direction can be changed to fit the crop being treated. This may be accomplished by slitting the top flange of the

4/ Mention of products in this paper does not imply recommendation or endorsement by the USDA over others not mentioned.

elbow and clamping it securely to the dust tube with a hose clamp around the flange or mounting a tightening bracket similar to that shown in figure 2 for the nozzle adapter sleeve. The ability to rotate the dust-outlet elbow allows the operator to position the discharge for variations in plant size and growth habits of different crops as well as for different cultural practices. By raising the delivery-outlet position and directing the spray downward, the tops of low-growing crops such as strawberries may be treated; in the case of potatoes, however, by lowering the outlet position and directing the delivery of pest-control materials upward, the under sides of the leaves may be treated, either alone or simultaneously with spray from the overhead nozzles.

The use of the atomizing nozzle assembly as described presupposes that the row-crop sprayer is equipped as a duster as well as a sprayer, and that the duster fan can be operated simultaneously with the spray unit. This would not be necessary in case it is desired that the spray be delivered without an air blast.

Except for the nozzle adapter sleeve, which was of steel, the experimental components of the nozzle assembly were machined from brass. The reducer fitting and the nozzle body were machined from hexagon bars and the stem from 3/8-inch round stock. Nozzles with adequate filter screens may be obtained from a spray-equipment dealer.

With a relatively few minor adjustments and modifications, it is believed that this equipment can be readily adapted to a large variety of low to medium height row crops such as bush beans, beets, lettuce, onions, and various cole crops for the application of insecticides and other pest-control materials.

RESULTS OF FIELD TESTS

The "vapor-spray" nozzle assembly described was tested extensively under field conditions during 1957 in experiments conducted in the Columbia Basin of Washington for control of the green peach aphid (*Myzus persicae* Sulz.) on potatoes. The nozzle performed well in practice, held up well, and, with a size 7 orifice, gave a fine atomized or misty spray at 1 gallon per acre per nozzle which distributed itself well through the foliage. With respect to foliage penetration and coverage, especially of the under surfaces of the lower leaves, the atomizing nozzles with the air blast seemed to be superior to the flat-spray nozzles of conventional design at the same overall gross rate. Aphid control results with the vapor-spray nozzle (Monarch type F-80 with size 7 orifice)[4/] also appeared to average somewhat better than with the regular flat-spray nozzles.

Two series of tests were conducted to determine the effect of rate on insect control. In both series atomizing nozzles were mounted in the dust-tube outlets and used in conjunction with flat sprays from the overhead branches. In one series, size 7 atomizing nozzles were used; in the second series, size 12 atomizing nozzles. The respective application rates of the 2 combinations were approximately 16 and 20 gallons per acre. At the higher volume (and with somewhat coarser droplet size) results were substantially better than at the lower gross rate with the smaller orifice and finer spray. Thus, 2 applications of endrin (0.5 lb. net per acre per treatment) with the coarse vapor-spray from size 12 nozzles at 20 g. p. a. gave an average population reduction (mean of 7 post-application counts extending over a 5 to 6 weeks period) of 98 percent as compared with 91 percent for 3 applications of the fine vapor-spray from size 7 nozzles at 16 g. p. a. (net endrin per acre 0.7, 0.6, and 1.0 lb. per acre for each of the 3 treatments, respectively). For the green peach aphid the minimum gross rate for efficient results would appear to be approximately 20 g. p. a.

No similar comparative data for a high-volume rate are presently available for the vapor-spray nozzles in comparison with standard hollow-cone or flat-spray nozzles.

LITERATURE CITED

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(4) Young, V. D., Joseph C. Chamberlin, C. W. Getzendaner, and C. E. Deonier. Improved Row-Crop Sprayer and Duster for Potatoes and Other Row Crops. ARS-42-10, USDA, Agr. Res. Serv., Agr. Engin. Res. Div., 14 pp., illus. May 1957.

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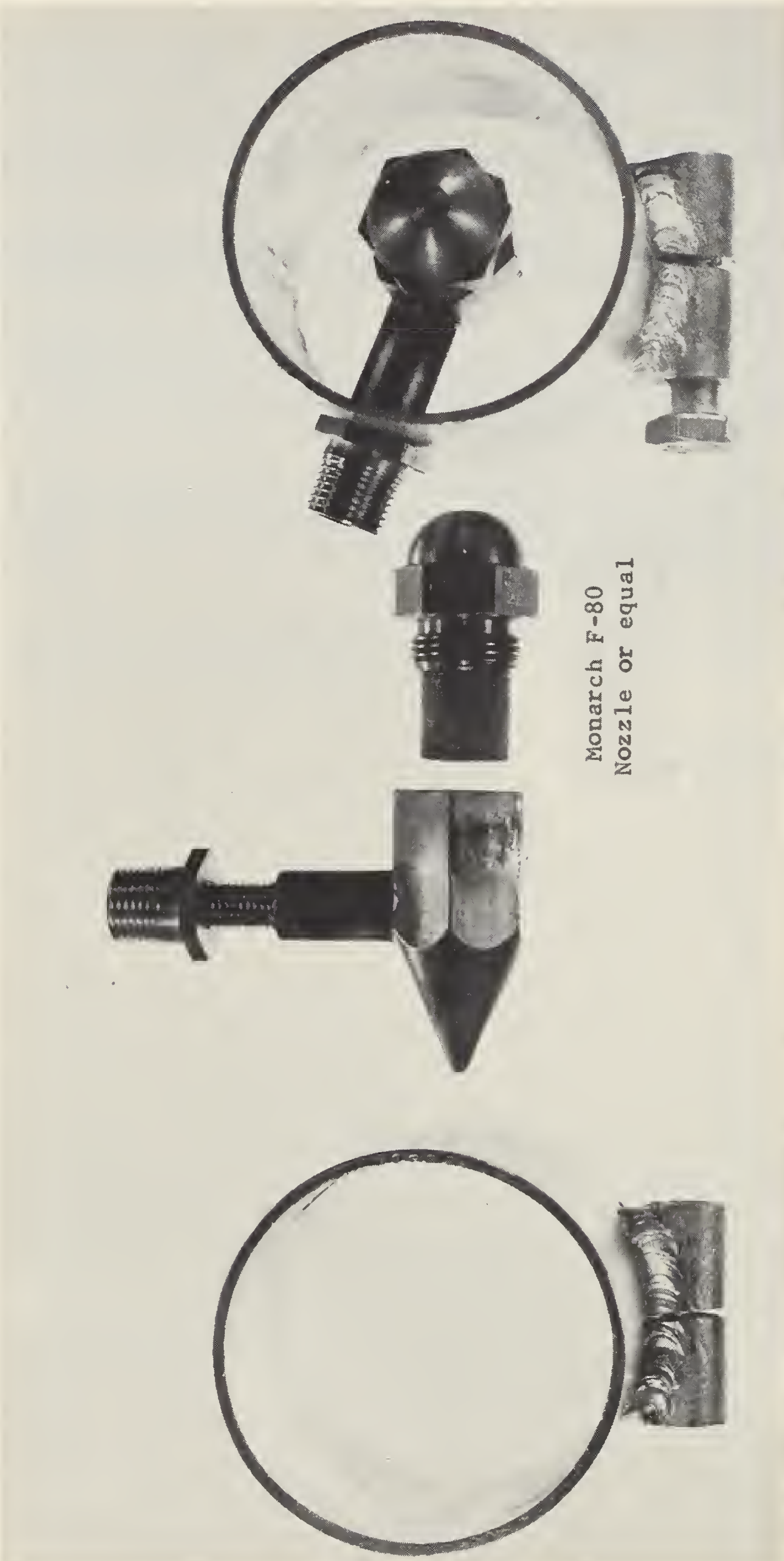

Figure 1
Pictorial view of Atomizing
Nozzle Assembly

ATOMIZING NOZZLE ASSEMBLY FOR ROW CROP SPRAYER

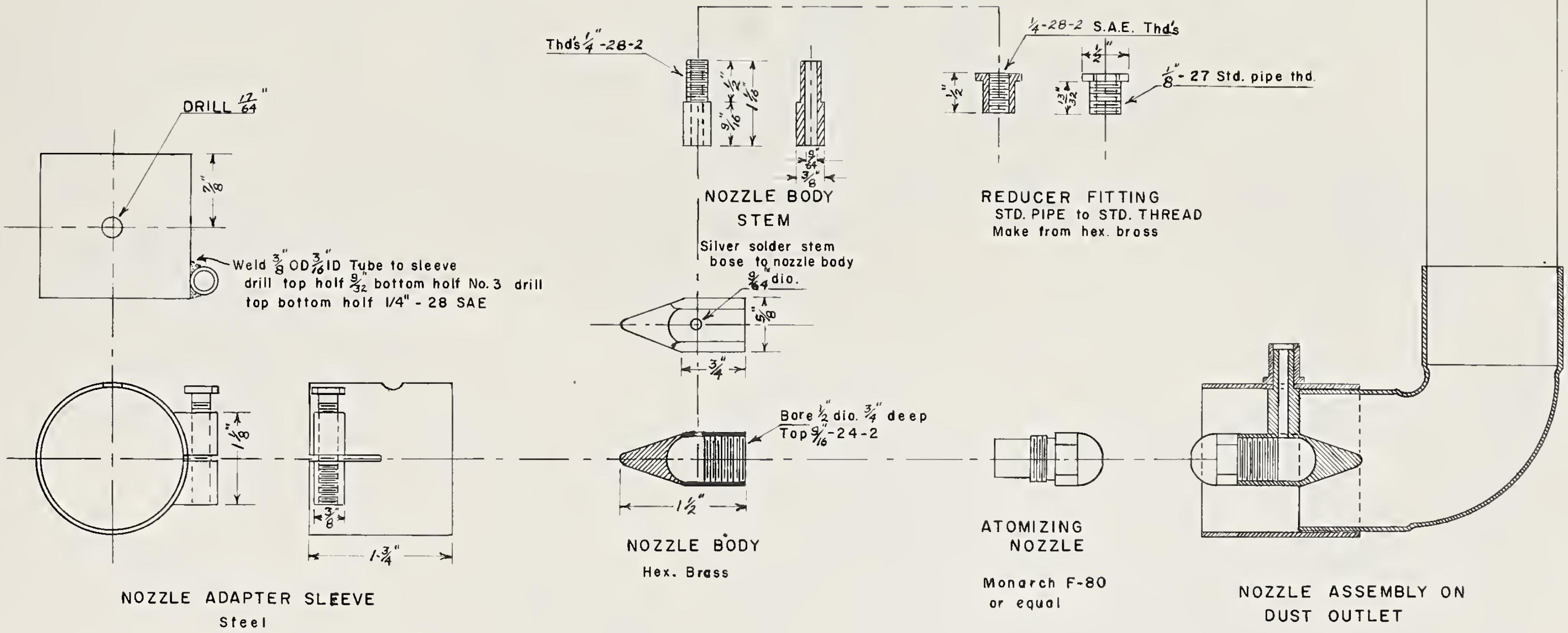

Figure 2